Is Large-Scale Low-Frequency Variability Satisfying Linear Barotropic Vorticity Dynamics?

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What is the dynamics governing the sea level variabilities at spatial scales larger than the mesoscale and periods longer than a few weeks? This question is investigated using the TOPEX/POSEIDON altimetry data. For periods shorter than a decade, it is believed that the large-scale variabilities In the open ocean should be barotropic and can be described by the barotropic vorticity equation:

$$\frac{\partial}{\partial t}\nabla^2\eta + \beta\frac{\partial\eta}{\partial x} - \frac{f}{H}\left(\frac{\partial\eta}{\partial x}\frac{\partial H}{\partial y} - \frac{\partial\eta}{\partial y}\frac{\partial H}{\partial x}\right) = \frac{f}{\rho g H}(\nabla\times\tau)_z$$

where η is the sea level height, H the ocean depth, f the Coriolis parameter, $\beta = df/dy$, ρ the water density, g the gravity, τ the wind stress. To avoid the error-sensitive Laplacian operator, the above equation was integrated over a large area. Preliminary analysis was performed in the northeastern Pacific, where the eddy energy is relatively low and the bathymetry Is relatively -th. Good correlation between the two sides of the equation was obtained at periods longer than 60 days. The largest error in the data is suspected to be the ocean tides. Empirical correction for the ocean tides will be performed for further analysis. Preliminary results of a global calculation will be presented.